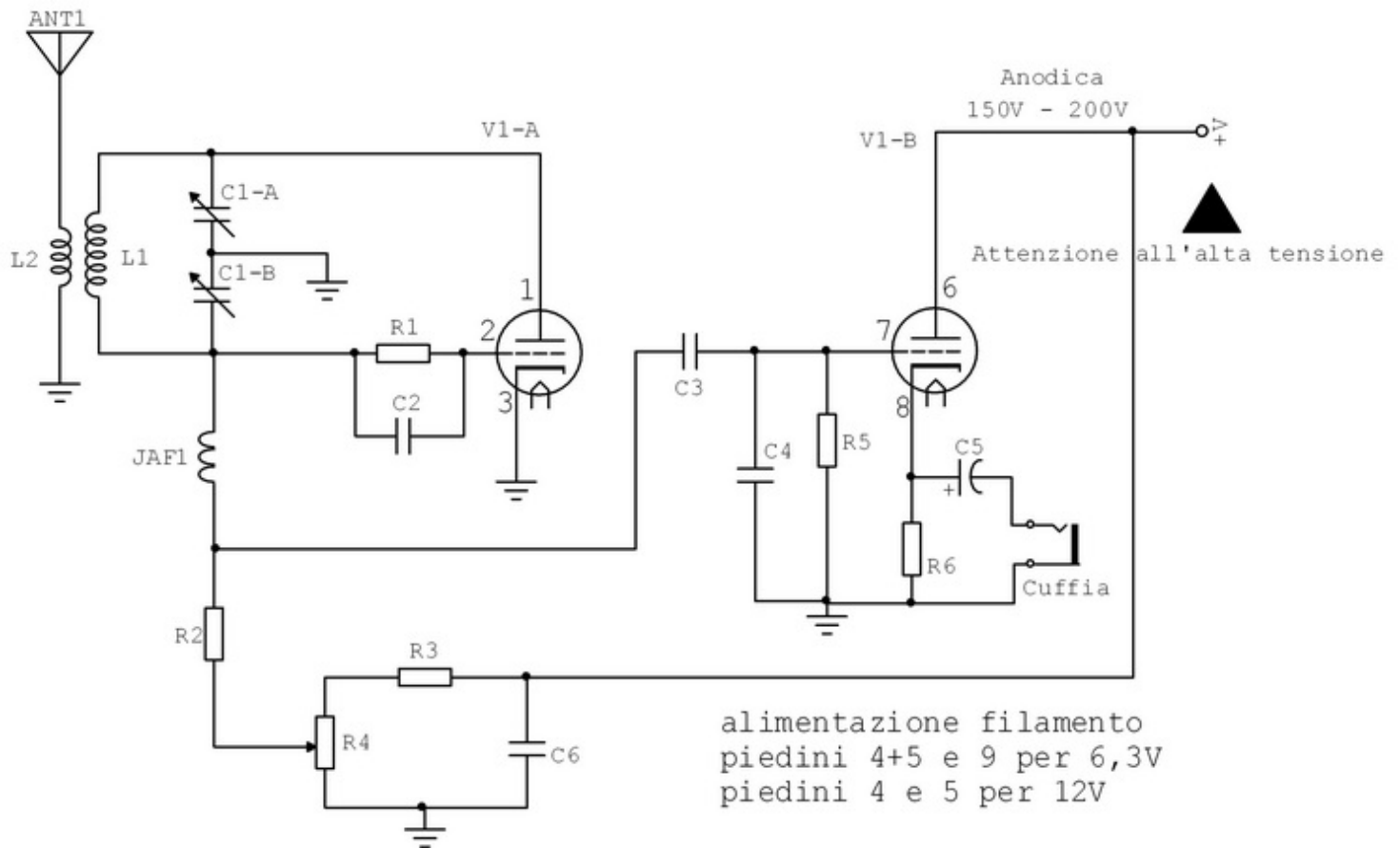


Superreaction receiver with ECC81 Regenerative RX with 12AT7



Ricevitore FM in super reazione con ECC81-12AT7

Building a receiver like this nowadays may seem like suicide.

Why embark on a critical realization and doubtful functioning from the point of view of quality, when it would be enough to buy one of the many monolithic chips all do in which virtually attack the antenna, headphones and battery, and you have better results than this.

Yeah, why ?!

Do you want me to list them point by point or do you imagine them?

I know, I know the answers you would give me, colorful, funny, offensive and elusive, accusatory and vaunting. The truth is that I needed to get involved.

Everyone talked, talked, talked about the social crisis in which we find ourselves, everyone pretended nothing, everyone put the ham on the eyes and the prepaid TV in the ears so that via cell phone we were more stoned than what in the end not we would always be lost in futile artfully created problems to mislead us from the real terror we are slipping into.

With only one salary and a wonderful family, I did what the state does not pass in the mind to do, cut the unnecessary expenses and, among these, the first to be eliminated, were the outlays for the purchase of radio, books and magazines.

At the beginning it was particularly frustrating, I do not deny it, I felt like a failure, but then I made myself a reason and I realized that, in the bad, I had found a lifeline to cling to.

I rediscovered the radios and books that surrounded me, I realized that I no longer considered them, occupied as

I was to accumulate as much as possible, to fill the void that left you the fact of not feeling part of a community indeed, a group of people who now thought only of their business.

So I went to the basement to dust the dust cover but, above all, to open all the shoe boxes full of disassembled components over the years and start their cataloging in order to build, build anything, equipment, joke, havoc, provided I felt alive again by putting myself to the test.

In all this psychological, psychiatric, sociological chaos, my friend Stefano Leopardi arrived and offered me an advanced radio editing course at his school, for the afternoon activities chosen by the boys. Advanced course because the base we had already done :-)

The project was ambitious, to build to the boys, after the galena in OM amplified with two transistors, a valve receiver but with the reception in MF.

After considering the few circuits that are on the net and on the books, the choice fell on the famous receiver of prof. Pegna and that you can find [here](#). The first step was to find the material and to test the circuit, eliminating immediately the uninsulated power supply from the network and using a New Electronics kit for the supply of valve devices. The second step was the appointment at school, on the 29th of December 2012, during which we handled the welder and prepared the first prototype, working immediately even if with some difficulty.

I admit, a bit 'skeptical I was, not convinced of the potential of the circuit, not convinced of using high voltage to boys and, above all, not convinced that it worked just so much so that, three consecutive times, we misfired for assembly errors.

But then, after listening to the first notes and voices, and having found that, after all, the project was not so utopian, I went on to build my own version, to make possible problems that could have occurred to the boys, and that's where the vicissitudes started.

Do not expect me a mathematical treatment of superreaction, they practically do not exist (at least in the books and magazines in my possession). The only deals in Italian on the web, which have some validity, [here](#) and [here](#). The disquisition is interesting and detailed, in an attempt to extrapolate the functioning of the FM superreaction, but does not draw a spider from the hole, in the sense that there are no certainties about the real mode of detection of frequency modulation.

Another help could come in an empirical form, using a whole radio frequency instrumentation, in order to have the possibility of achieving maximum performance using the equipment and the empirical replacement of the components, logically knowing why and what to replace. In one way or another, I wandered into the limbo of the evolved kit builder, that is, that freak being that is neither a designer, nor a graduate, nor a rich one who can afford the purchase of what you want, that is of that Sunday animal that has survived since the radio-electronic culture has had light.

The devices in super-action are suitable for the reception of very high frequency signals and with excellent sensitivity, despite requiring a small number of components and allowing the detection of signals both amplitude modulated and frequency modulated.

They are easy to build and are very simple, but require a set-up that is often laborious and that makes mass production virtually impossible, as each receiver is a world apart.

They usually consist of a detector valve followed by one or two audio amplifying valves (the same is true for transistor circuitry).

The sensitivity of the detector valve in reaction is extremely high but it is for a very short time since immediately after the valve starts to oscillate making us hear the typical whistle in the speaker and starting to transmit disturbing the equipment of neighbors.

It has therefore been thought to prevent the valve from entering oscillation, by making its operation intermittent around the point of maximum sensitivity of the valve, that is to keep the operation of the valve suspended between the moment of triggering of the oscillations and the moment immediately before, turning off the oscillations every time they exceed a certain threshold.

If the intermittences were 100 per second, reception would be impossible because the resulting signal would be a dark buzz; as the intermittences increase, the buzzing gives way to a sharp whistle and then to a rustle, so it is from there that we try to create intermittences that are outside the upper hearing threshold of the human ear.

This intermittence, is called the *extinction frequency*, and in general, to obtain the above result, a frequency of 100Khz is applied to the detector, so that each positive half-cycle corresponds to the valve operation and to each negative half-cycle it corresponds to the valve locking same.

The drawback of this type of reception consists in the fact that at each operating interval many cycles of the incoming signal must correspond. If the shutdown frequency is 100KHz it will be impossible to receive long waves

or medium waves, and if you want to receive ultra-short waves, receiving 100MHz signals would have 1000 cycles of incoming signal for each cycle.

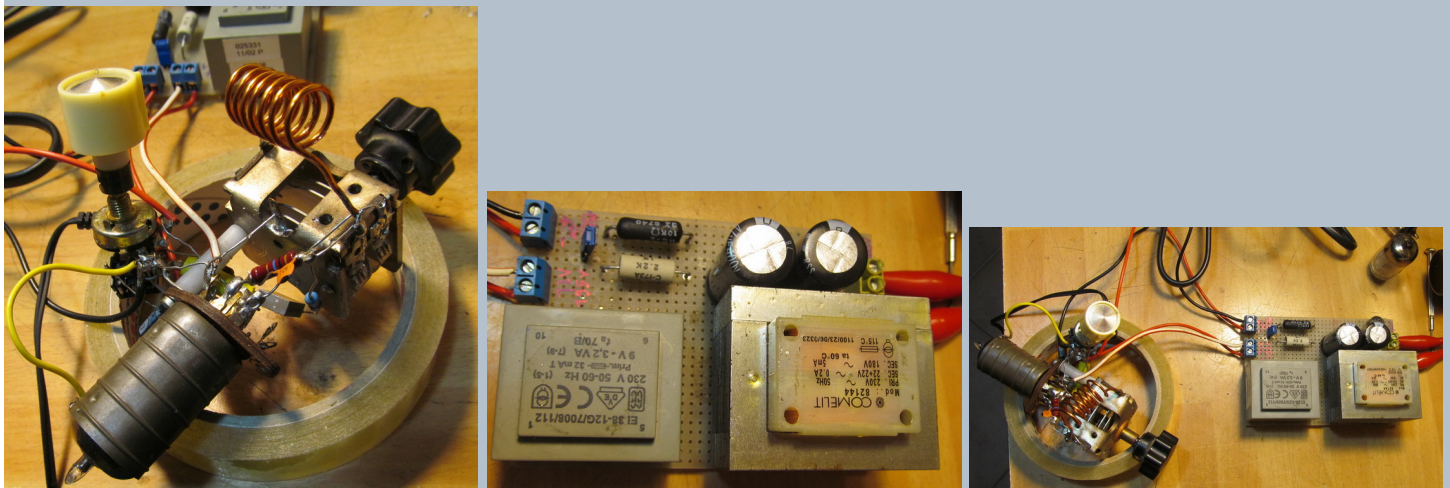
Our circuit is of the self-oscillating type, the left triode in the electric scheme acts as a grid triode detector and oscillating triode. The antenna group, in addition to performing the usual functions of tunable range, constitutes a Colpitts oscillator. The JAF1-C3-C4 group constitutes the cell that together with the triode generates the extinction frequency; the two resulting signals will subsequently be revealed in grid flaws.

The potentiometer R4, by varying the anodic voltage of the triode, varies its operation (switch off and oscillation). The left-hand triode is a simple low-frequency amplifier triode once the signal has been detected, in which the R5-R6-C5 components constitute the components that correctly polarize the trip. Capacitor C6 filters the spurious signals into radiofrequency to ground.

THE CONSTRUCTION AND THE LIST OF THE SAINTS

What you see is the first version of the receiver we have talked about so far.

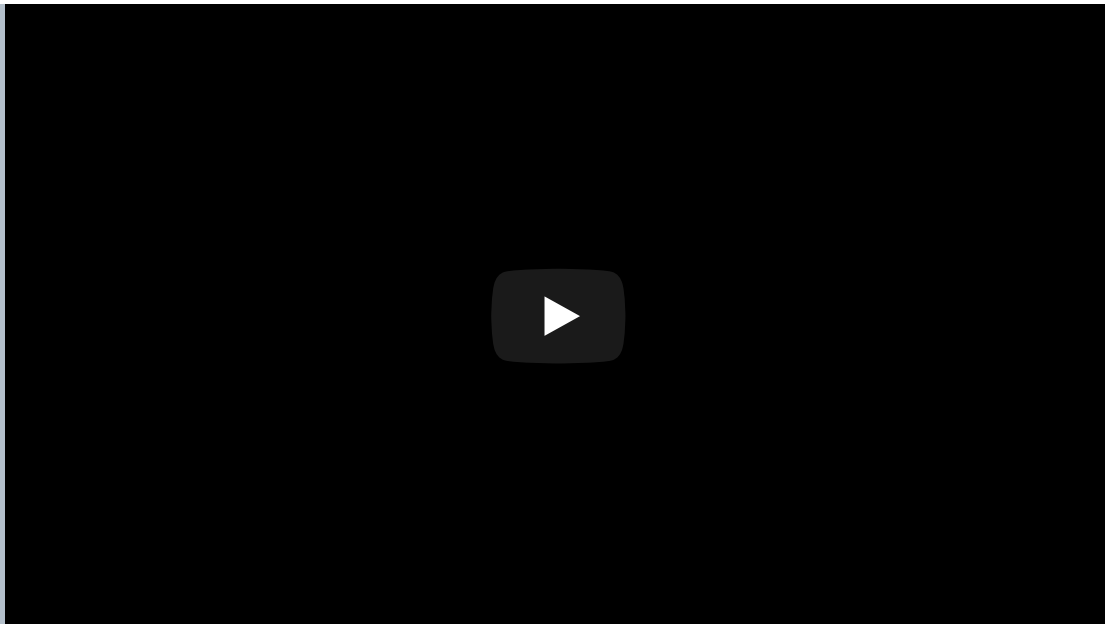
It is built in an absolutely Spartan way, taking into account only the length of the wires and the terminals of the components. The power supply is essential but also spartan, without frills, even the filament is powered by the 9V transformer instead of the necessary 12V, as, under load, the transformer pulls out 12V instead of 9V mah, the mysteries of the copper electron !



In the first tests done with Stefano, they powered the radio at 150V of anodic, the power supply used in my case has two voltages, 170V and 200V, does not change practically anything to the ear deafly humanoid like mine, if I had the instrumentation, maybe some more info I gave it to you The only noteworthy difference is the displacement of the point where the reaction intervenes. You can even go down on 130V, but the more you go down, the more the reception, the reaction capacity and the output level decrease.

Turned on the circuit, I bowed to His Lordship Superreaction: although I found a house point (the usual closet) stingy with radio waves, I could easily receive many commercial stations with a good volume on the headphones, holding the command of the reaction just the typical rustling started, from nothingness to chaos in a light touch. Compared to the original scheme, the value of the double variable capacitor and the number of turns of the chord and oscillation coil had changed. In this situation there was a lot of buzzing in the background, a remnant of the alternate, although tolerable and there was an accentuated hand effect. There was no antenna and no loose coupling, just as the welder had created. Computer speakers, even if powered continuously by batteries, at maximum volume,

In all this beehive nest, antithesis of the measurement laboratory, listen to the number of stations that you receive and, in general, the quality of the stations received in function of the simplicity of the assembled circuit. In the evening, with the headphones, as the external noise and interference diminished, the audio quality increased.



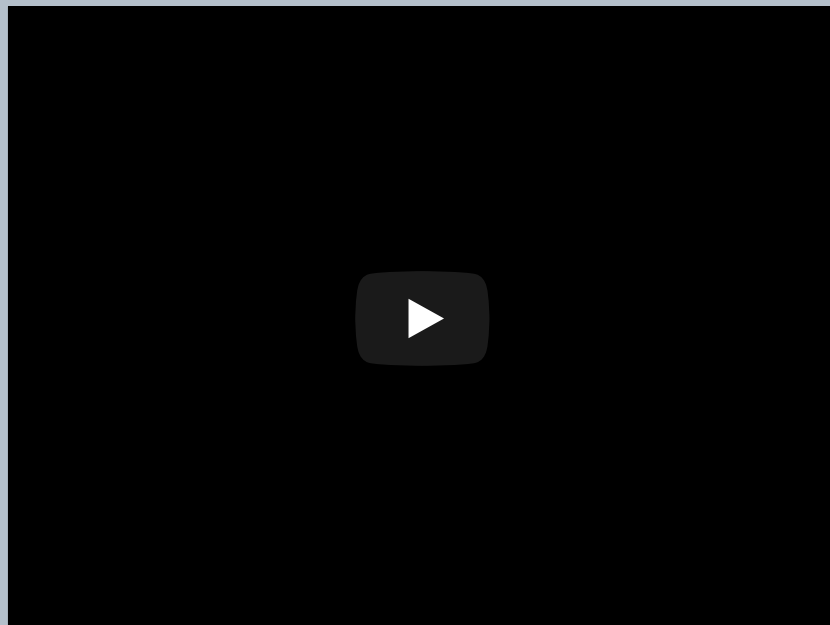
After these comforting results and after verifying the problems that the boys might have encountered, I decided that I would have prepared a small wooden frame at least to give some solidity to the structure and a better arrangement of the components. Actually I just picked up the receiver and screwed it to the wooden front panel, putting the power supply on the insulating surface, always made of wood, so as not to risk unnecessary short circuits.

The result?

Disappointing.

The reception was no longer the same, the signal seemed to have given way to the noise, although the test locations were always the same, the reception seemed silenced, even changing the valve with other functions, the result did not change. Then I started to change the assembly plan, changing the arrangement of the components, moving away, approaching the distanced and approachable, but the only result I got was the displacement of the receivable band (I have also come to change the speakers. ...).

You can listen to the result of the second experiment and watch it in this video.



Disappointed and disheartened, I went to Stefano's house one Saturday to help me untangle the skein and learn something and instead, after a good coffee, my receiver started playing almost like a commercial superheterodyne: clear and strong sound, even with the addition of an external antenna, which considerably increased the audio output (which I had not been able to do at home because it was replaced by a strong buzz that obscured any transmission). In addition we had connected the valve amplifier that was the other part of the school project and the sound was powerful and full-bodied.

Perhaps the receiver had had a mystical transmutation in road transport or had been blessed by an intergalactic

wave coming from the XTY56 sector of the Bravosian galaxy or, simply, it was the usual c ... of the Sunday arranger that in the presence of the supreme master bowed to the knowledge

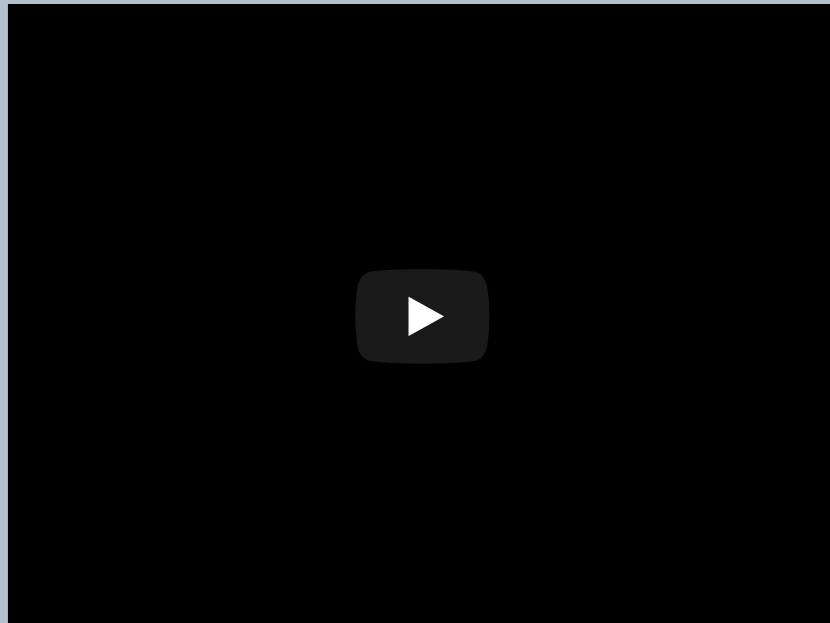
I can not explain it, coming home from Stefano I felt relieved, all the hours lost to make changes and attempts, had led to the creation of a spectacular receiver, the results far above my expectations and the very good sound quality.

I returned home and, after falling asleep, I put on the headphones and I tried again the reception and I took the calendar and I enumerated in alphabetical order the sanctified progeny of past centuries. Joke, some dirty word I pulled it down, but nothing striking because if I had really named all those saints, you know the money I would have to pay in copyright

Nothing had changed, everything as before, but at least I had the certainty and awareness of what the good Ravalico and good Brazili had been preaching for years now: every receiver in superreaction is a world in itself, both on the constructive side and in the context in which it is used.

The test was exhaustive, at Stefano's house it was received that it was a marvel, in my house a crap.

Since I had nothing to do, I changed the circuit again, which by now was taking on the definitive aspect and I started the tests again. The following is the result.



During the tests I notice a strange behavior: just before the sudden reaction comes into operation, there is a zone of rotation of the potentiometer in which there seems to be a clean radio reception from the noise. Since the grid voltage oscillated around 27V, I decided to extend this range of variability by replacing the 100Kohm potentiometer with a 47Kohm resistor series and a 22Kohm linear variation potentiometer. In this way, that point of radio grace was perfectly manageable and easily adjustable.

The receiver began to have its own soul and life.

I get inspired by optimism and I also try to insert the antenna winding. Now the generation of the buzz is not as unmanageable as before, I make a thousand attempts between number of turns and positioning of the loop and arrival at the optimum, using two coils of the same diameter of the antenna coil with one end to ground and the other connected to a stylus antenna. Now the signal is strong enough and the sound is clean enough. I block the antenna coil with the cyano-acrylic glue and I relax by scrolling through the frequency modulation range, enjoying the long-awaited success and letting myself be lulled by the silence that only night can give you.

This is the final result, divided into two videos due to Crozza's intervention in Sanremo.



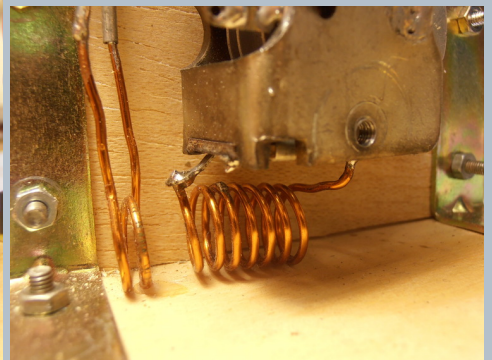
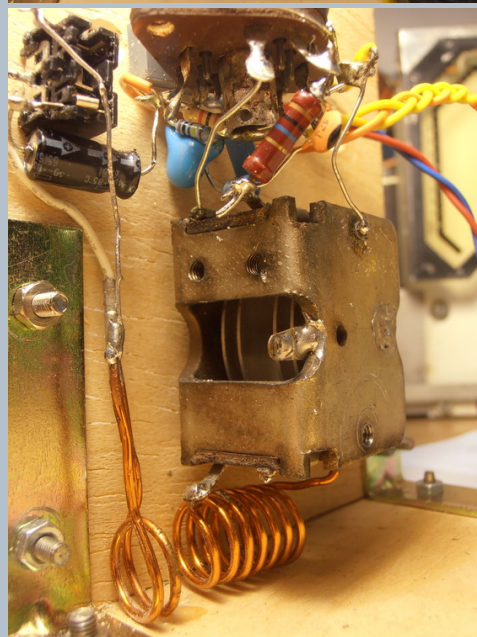
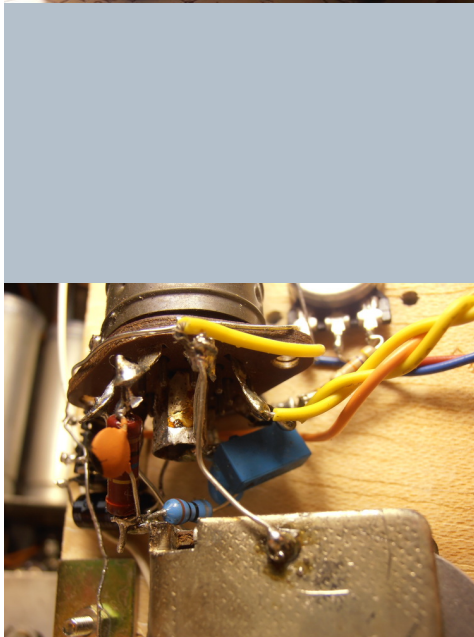
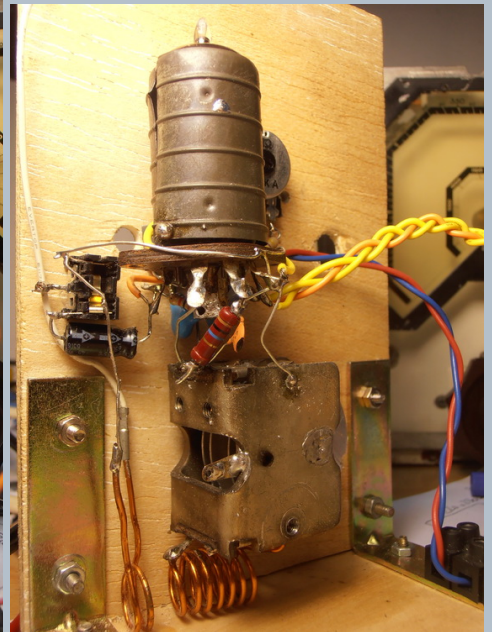
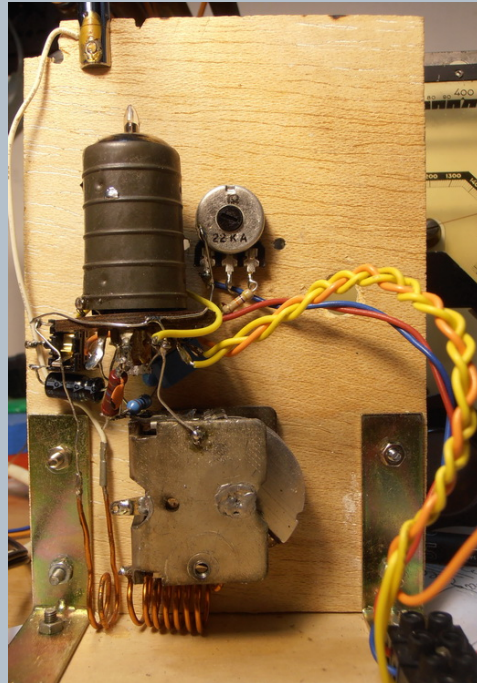
This time I let the video talk rather than the images, I inserted the photos of the initial realization and I finish by inserting the photos of the final version.

As usual, I did not pay attention to the aesthetics, but rather to the final result I had proposed. I am certain, because experienced, that the receiver built in this way will give its best under all circumstances, as improved in the worst reception conditions, those of my house.

I do not want to, an excellent project is the combination of all the aspects that compose it, I always defect in the aesthetic one but I will improve, one day.

The complete project involves the construction of the power supply and the low-frequency power stage, but these topics will see the light editor later. **BUILDING TIPS, WORKING EXPERIENCES AND FINAL IMPRESSIONS**

Where do we start? I do not know, I go in random order, just like memories come back to me. **Defects and advice.** The circuit has its own heart and, therefore, its own independent life. Mine will be different from yours and the constructive or implemented strategies that you will adopt will be similar, but it is said that they reach the same result.



Do not use long, parallel or 90 ° links as well as hieroglyphs: high frequency editing has few basic rules and these are some of those. If you can, use rigid wire not interwoven as those normally used in electronics, for example the resistance terminals are excellent, use links like those, sell them already made but you can also find them in vintage wires peeling. You can use the copper wire of the transformers that you will have scrapped, but you will

have the hassle of the peeling and the subsequent welding before putting them in place.

As usual, it is a must to use what you have at home, especially in this period of crisis (and then become an anti-consumerism philosophy).

The circuit is not very selective, not because of me, but because of how it was conceived.

Trying to get a high sensitivity has had to give way to selectivity. In OM and OC low there is the problem that between one channel and the other there are 9-10Khz with a signal of amplitude however very strong of the order of mV. However, having to do with the high frequencies, the view is reversed, we must go to look for very weak signals, from 5uV up but with bandwidths of separation between one channel and another of about 200KHz. So when you have two stations nearby, or you hear them together, or the most powerful will overwhelm the weaker. You can maneuver the variable capacitor to try to get the best reception, perhaps using a manopolone or reducing the rotation (in this case it would go against the cheapness of the realization if you buy a knob specially gutted, try to invent a tuning system with lanyard or use a large knob, maybe the cap of one liter bottles of fruit juice, in short, the choice that is most congenial to you).

You'll probably need a valve shield. It is a choice that you will have to face straight away, otherwise you will have to lose the track again. The screen isolates the valve from the hand effect and the residual humming but becomes part of the tuning and reaction circuit. It is one of the faults of the circuit: the construction, the components, the connections, everything becomes part of the reception and the reaction, first you understand this and first you will be able to understand the behavior of the receiver, without the need for mathematical formulas and instruments scientific.

The capacitor used in this receiver, is a double variable in air 8-19pF then, thinking about the small capacities involved,

In the absence of a tuned signal, a loud background noise is heard, which disappears almost completely when a sufficiently strong station is tuned in, noise that still annoys, especially in prolonged listening or in headphones.

The receiver, as a reaction, is an excellent transmitter on the tuned frequency: you must then duly measure the reaction in order to avoid that the roommates of the building, aware of your passion, waiting for you outside the door and beat you to the sound of music.

It is possible that the hand effect is present, an effect that leads your hand to be part of the tuning circuit and that leads to the variation of the tuned frequency according to the distance of your hand from the variable. You can avoid this problem by using the aluminum front panel, to the ugly use aluminum to cook in film, try what happens if you put it to ground or not. In the final configuration the hand effect was not there while it was present in the initial one.

Give the valve a few minutes to warm up and arrive at an equilibrium temperature with the environment in which it is located; this will lead to no frequency shift during listening.

For all the observations reported so far, we understand how the use of these receivers is limited to amateur receivers or particular applications, but despite everything is a configuration that gives enormous satisfaction to those who venture into the world of VHF with the superreaction for the first time: it is a great bench on which to experience and learn new concepts.

Highs

After having exposed all the problems that may arise, I guess I'll find mica so many advantages

The receiver is built with very few components, without coils with strange initials, with pieces that you can easily find in your drawer or at fairs (I'm talking about the condenser and the valve). The receiver is cheap, the valve, fortunately, is not widely used by audiophiles, so its price does not suffer the mood of the market. The variable condenser Stefano paid him at the fair € 2.50

The receiver, once you have worked on it, it works really well.

You can use the headphones that you use for media players, so you can purchase them at little cost, or you can connect external speakers for computers, even if the sound output will not be particularly powerful. When you go to the usual Chinese store, check the specifications that the headphones are from 32ohm impedance, otherwise a low and distorted sound output.

The receiver allows you to experience in high frequency and allow you to learn new things, which is not a little. It is possible to receive a wide range of frequencies, modulated both in amplitude and in frequency, giving you the possibility to discover amateur ranges otherwise out of reach.

The power supply can be obtained using two transformers sold in Chinese shops, those with primary to 220V and multiple secondary, from 1.5V to 12V. I bought two for other purposes, from 1A and I paid € 4.5 each, if you take those from 500mA cost you € 1 less. If you use the 6V or 12V outputs you can also feed the filament in series or in parallel. The anodica requires at most 5mA (remember primary-secondary-secondary-primary).

In short, I do not have other things to say only that, as you have heard, the receiver works really well (and unfortunate not to have registered at Stefano's house ...).

Last-minute tips

I recommend using the earphones: the closer they approach the 64ohm required impedance, the greater the volume in headphones and the better the sound quality. I have tried 7 of earphones and only two have given the desired results, even if no one takes me out of my head that at most are 32ohm headphones. As mentioned previously, an incorrect and low output impedance leads to increased distortion and headphone output volume.

The impedance L1 regulates the tuned band and the type of oscillations. With the double variable capacitor in my possession that does not exceed 20 + 20pF and the copper wire of that diameter, 7 turns were needed to have the whole FM band receivable with only a few degrees of rotation of the lost capacitor. Depending on the capacitor in your possession you have to jig on the turns and their distance to have the whole band and avoid the overlap between the stations and the same applies to the diameter of the wire you have, must still be close to that indicated in the original scheme. If the thread was unglazed but silvered, things should be better.

The coil L2 you have to try with the assembly that you will have: you will have to test the distance from the L1 for which you have greater coupling and therefore output signal strength and minimum residual hum. Test.

As for the JAF1, try all the reels you have, as long as the value is between 5 and 10 micro Henry. The higher the value, the less stations you receive, the more difficult it will be to react. At the moment there is a commercial 10uH reel mounted, I had mounted one when I went to the house of Stefano that his digital inductance measured 7uH, commercials less than 10uH I had to try.

I tried to mount an ECC83 but the result was not exciting. He behaved well, some stations felt limpid, but the management of the reaction became impossible and the point of work of grace that I had found was no longer found. You probably have to rebuild the circuit on that valve, you can try if you do not already have it in the drawer and you do not want to spend the money.

Depending on whether you use the headphones or the external speakers of the computer, you will have to manage the socket for female audio jack: if you use the computer speakers, the head that goes to ground connect it with the control unit of the female jack.

Depending on whether you use the headphones or the external speakers of the computer, you will have to manage the socket for female audio jack: if you use the computer speakers, the head that goes to ground connect it with the control unit of the female jack, the output will be monophonic but the output power and quality will increase significantly.

Remember to connect the screen to ground and place the wire so as to have as little buzz as possible.

In the receiver mounted by me, three operating modes can be identified.

Before arriving at the threshold where the reaction is abruptly inserted, there is a state of grace that allows you to listen to the stations without the shadow of rustle, as you can hear from the last video. In this state the outgoing sound volume, although still manageable through the potentiometer, does not have a particularly high level.

When it comes to the actual reaction, noise and volume increase significantly. Once the station is centered, the noise will disappear almost completely but it will still be present. The higher the level of the signal that we will receive in the antenna, the less will be the noise in the headphones.

There is the third and last state, in which, continuing to increase the reaction, it will be possible to tune a station as if it were at the center of the minus flex of a sine wave. By turning the potentiometer slightly to the right and slightly to the left, you will hear a whistle soaked in rustle; in the background to the centered station you will always find the usual rustle. Generally, this behavior occurs when a very weak station is received.

List of components

V1 = valve ECC81 or 12AT7

R1 = 10Mohm

R2 = 100Kohm

R3 = 47Kohm

R4 = potentiometer 22Kohm linear

R5 = 1Mohm

R6 = 1Kohm

C1 = variable capacitor in air 20 + 20pF

C2 = ceramic 47pF

C3 = 10nF minimum 100V

C4 = 2.2nF

C5 = 25uF 16V electrolytic

C6 = 10nF 250V or more

L1 = 7 spiers spaced 1.5mm, diameter 1.4mm thread on 1cm support

L2 = 2 spaced spaced 1.5mm, diameter 1.4mm thread on 1cm support

JAF1 = 5-10uH Noval

valve plinth with screen support or take the screen separately.

Stereo jack to be connected with the two earphones in series (do not connect the central mass terminal).

2 knobs for tuning and reaction.

mammoths for connections.

Directional stylus antenna.

For resistances to the maximum use from half a watt but also 1 / 4W should not give problems.

It is time to conclude.

I set up the article as if it were a conversation between friends. I hope that the time taken to read the article and watch the videos was pleasant and relaxing.

See you next time.

Carlo.

PS I remembered, when I inserted the biography, that the third electronic kit that I bought in the distant youth, was just LX441 present in the number of Nuova Elettronica 74. I remember that I was very bad at the end of the editing because I only heard rustle and I could not to capture no station, even in FM. If only someone had taught me how superreaction was managed and how was it to be received, I would probably be another man today, better? worst? boh !!!! I tried to find it in the cellar, but I could not find it, who knows what happened to it, I would have liked to lose my hands today

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